

Biospheric Sciences Branch Highlights
Code 614.4
November – December 2005

- **Science policy meetings, Science team meetings, Workshops**

**** New Landsat Data Continuity Mission (LDCM) Memorandum from OSTP**

The Director of the Office of Science and Technology Policy (OSTP), Dr. John Marburger, III, signed a memorandum on December 23, 2005 with a subject line reading "Landsat Data Continuity Strategy Adjustment." This memorandum revises guidance provided by Dr. Marburger in a previous memorandum, dated August 04, 2004. The earlier memorandum directed agencies to place Landsat-type sensors on National Polar-orbiting Operational Environmental Satellite System (NPOESS) platforms. Following evaluation of the technical complexity of integrating Landsat-type sensors on the NPOESS platforms, the new memorandum directs the Departments of Commerce, Defense, the Interior, and NASA to "Proceed with the NPOESS program without incorporating a Landsat-type instrument." The memorandum further directs NASA to acquire a single "free-flyer" spacecraft for the LDCM and assigns the Department of Interior / United States Geological Survey responsibility for operating the spacecraft. The memorandum also states that the transition of the Landsat from a series of independently planned missions to a sustained operational program remains a goal of the U.S. Government.

**** Jeff Privette gave a presentation on the various Land algorithms to be used in NPOESS during the Annual Polar Max Conference held at the NOAA Science Center in Silver Spring, MD on October 25-27, 2005. The conference is a user forum for the environmental monitoring community, bringing together multiple government agencies, academia, industry and stakeholders interested in the current status and future plans of the United States polar-orbiting satellite systems and those of its European partners. Jointly sponsored by the NPOESS Integrated Program Office and the heritage polar program offices, this year's conference focused on advanced sensors under development for the next generation of polar-orbiting satellites, as well as advances in remote sensing science and information extraction from satellite data. Users discussed operational applications of the data and their preparations for NPOESS. NASA speakers included Chief Engineer Chris Scolese (Keynoter Day 3), Ron Birk NASA/HQ SMD, and from GSFC: Dr. Franco Einaudi, Dr. Michael King, Dr. Wayne Esaias and Dr. Jeff Privette.**

**** Ross Nelson presented at the Northeast Mensurationist Organization meeting (NEMO) in Freeport Maine. His presentation was entitled "In search of variance**

estimators for regional airborne lidar surveys". His co-authors were Tim Gregoire, Yale University, Erik Naesset and Terje Gobakken, both of the Norwegian University of Life Sciences, and Goran Stahl of the Swedish University of the Agricultural Sciences.

** A. Lyapustin attended the MISR Science Team Meeting in Pasadena, CA, Dec. 12-13, 2005, and presented a poster "Analysis of MODIS-MISR Calibration Difference over Land," by A. Lyapustin and Y. Wang. The analysis of MODIS and MISR data based on two different approaches reveals the systematic discrepancies in the calibration of two sensors from 2% to 5% in the visible spectral bands.

** Landsat Calibration Working Group Meeting Summary

The Fall 2005 Landsat ETM+/TM Calibration Working Group meeting was held in Primm, NV on December 1-2, 2005. The calibration working group consists of the Land cover satellite Project Science Office (LPSO) personnel from GSFC (John Barker and Brian Markham of Code 614.4; Julia Barsi, Ed Kaita, Jennifer Sun, and Cherie Miskey of Code 614.4 SSAI; James Storey of Code 614.4 SAIC/EROS/USGS); Landsat project personnel from USGS EROS; and four teams from universities and JPL conducting primarily vicarious radiometric calibrations (Dennis Helder, SDSU; John Schott, RIT; Frank Palluconi and Simon Hook, JPL; and Kurt Thome, U of Arizona) and Phil Teillet from CCRS. This group meets twice yearly to discuss the latest calibration results for the Landsat 4, 5 and 7 TM/ETM+ sensors. Recent JPL vicarious calibration results indicate that the Landsat-7 ETM+ band 6 temperatures are low by several percent at high brightness temperatures (30 – 55 C), though they are consistent with vicarious calibrations at typical water temperatures (5 – 20 C). Landsat-5 TM band 6 results have continued to show a bias averaging about 0.8K relative to the vicarious calibrations from both RIT and JPL. The Landsat-7 ETM+ reflective bands continue to be stable to within the ability to monitor them with the on-board (GSFC) and vicarious calibration measurements (U of Arizona and SDSU), i.e., <0.5%/ year. The Landsat-5 TM reflective bands also continue to be stable; an update to the historical calibration of the Landsat-5 TM, based on trending results from a North African desert site was presented (GSFC). A cross calibration of Landsat-4 and Landsat-5 TM's using North African data was presented by SDSU. It is anticipated that the thermal band analyses for Landsats 5 and 7 will be sufficiently confirmed within the next 6 months for implementing a correction in the processing system. Analyses towards a Landsat-5 calibration update and Landsat 4/5 cross calibration will continue with the intention for completion within the year.

- **Significant activities**

** Michael King announced that Dr. Marc Imhoff agreed to serve as Terra Project Scientist, replacing Dr. Jon Ranson, who has ably served as Project Scientist for the past 5 years as well as Deputy Project Scientist under Yoram Kaufman for the previous 4 years. Dr. Imhoff is an internationally recognized scientist with a background in the use of remote sensing and computer modeling to study human impacts to the biosphere and climate resulting from altered biogeochemical cycles. Imhoff previously worked as an instrument manager during the formulation of the EOS AM-1 (Terra) mission and later served as the Earth System Science Pathfinder Project Scientist from 2000-2004. Since Terra is one of the nation's flagship missions for Earth science, Imhoff will play a key role in the management of interdisciplinary science and data fusion activities carried out as part of the Terra Extended Mission and will make a very substantial contribution to the Terra mission and represent the Earth science community in an exemplary fashion.

** The sixteenth William T. Pecora Memorial Symposium, PECORA16, was held Oct. 23 - 27 in Sioux Falls, SD. Jim Irons served on the steering and technical program committees, chaired a session on land remote sensing policy, and presented "Integrating Landsat Sensors onto National Polar-orbiting Operational Environmental Satellite System Platforms." Additionally, Laura Rochio, SSAI supporting Code 614.4, chaired a session on data archive and access and presented "The Landsat Legacy: Tracking Down Three Decades of Knowledge" and Jeannie Allen, SSAI supporting Code 614.4, presented "Bringing Land Remote Sensing to the Public and the Classroom."

** Jeff Privette was invited to join the GOES-R Algorithm Working Group by Dr. Mitch Goldberg, Chief of the NOAA/NESDIS/ORA Satellite Meteorology and Climatology Division.

** Piers Sellers, NASA astronaut, and former member of the Biospheric Sciences Branch visited the Branch and has been working with Branch members on a paper during the period November 7-11 and December 19-23.

** Jeff Privette has been working on a manuscript on an LST algorithm sensitivity study, and finished two proposal reviews for NASA HQ.

** Tom Brakke as an appointee to the Center's Persons with Disabilities Advisory Committee, attended the special "Can We Talk" for People with Disabilities, Monday, October 31. This session with Dr. Weiler was in observance of Employment Disability Awareness Month. The session was well attended, and lasted for over an hour. Dr. Weiler took an action item to obtain more authority for one of the attendees who was part of the approval process for assuring the

accessibility of Goddard web pages to the disabled. Several attendees expressed the desire that Goddard-produced TV programs should be close captioned, but Dr. Weiler claimed that this was an issue for NASA HQ.

** Elizabeth Middleton served on the organizing committee and as a session chair at the Optics East SPIE conference held in Boston, Massachusetts between Oct. 23-26, 2005, for the Sensors and Applications Conference, #5996: "Optical Sensors and Sensing Systems for Natural Resources & Food Safety and Quality". She also presented a paper and was a co-author on a second paper.

** Jeff Privette co-convened a NPP Land Products session at AGU in San Francisco. He also was co-author on two oral and one poster presentations.

** Jim Irons presented "Land Measurements from Future Landsat Meetings" at the AGU meetings on Thurs., Dec. 08. The presentation was made during a session organized and chaired by Jeff Privette on land observations from the NPOESS satellites.

** Landsat-7 ETM+ Internal Calibration Lamp Stability/Radiometry Presentation

A one-hour presentation was made by John Barker at the semi-annual Landsat Calibration Meeting held in Primm, Nevada on the potential use of the Internal Lamps on the Landsat-7 ETM+ for characterizing the stability of ETM+ imagery. The importance of this presentation was that Landsat-7 ETM+ is considered a possible candidate reference sensor for all Land Remote Sensing Satellites and this talk demonstrated the potential for applying corrections for temperature and lamp current effects that might allow the Internal Calibrator (IC) historical record to be used with the Full Aperture Solar Calibrator (FASC) on ETM+ to recalibrate imagery. The problem has been that the ETM+ detectors have been more stable than the calibrators, making it difficult to characterize just how stable ETM+ is and impossible to recommend changes in calibration to those from pre-launch testing. This talk illustrated the inherent slowly varying within-path within-band precision of ± 0.01 to ± 0.05 % for both IC and FASC gains, which is 2X to 10X better than instrument requirements. If such on-orbit instrument stability can be verified in the next few months, then it may lead to a need to assure that any Landsat Follow-On radiometric specifications are no worse than the historical archive. The important action is to follow-up these initial partial corrections with full corrections for characterizing and calibrating the individual reflective bands on ETM+.

**** Landsat-7 ETM+ CBERS/ResourceSat Spectral Simulation Study
(Landsat-7 Data Gap Studies)**

An interagency Landsat Data Characterization Working Group (DCWG) met on 13-14 December 2005 in Greenbelt, MD. DCWG is addressing technical questions associated with the possibility of filling the gap in the 35-year Landsat archive with imagery from foreign sensors before imagery from a free-flyer follow-on mission becomes available.

A spectral simulation talk given by John Barker addressed the question of how to quantify the effects on radiometry from // sensors with different spectral band passes such as those on the Chinese/Brazilian CBERS and the Indian ResourceSat satellites. This is an important question for any cross-calibration effort since spectral differences cannot be normalized out. This simulation activity will create a capability at Goddard based on an existing one at the Canadian Center for Remote Sensing (CCRS). Initial results indicated CBERS spectral differences from ETM+ of 20 % for some targets in the Shortwave Infrared (SWIR) bands. Differences for ResourceSat were less, especially in the Visible and Near-Infrared (VISNIR). Perhaps surprisingly, the spectral responses differences from ETM+ for both foreign satellites were less for various vegetative indices than for the individual bands used to create the indices.

• Published Papers

**** Alexei Lyapustin and Yujie Wang, "Parameterized Code Sharm-3D for Radiative Transfer Over Inhomogeneous Surfaces", Applied Optics, v. 44, N. 35, pp. 7602-7610, 2005.**

**** A. Lyapustin, "Radiative Transfer Code SHARM for Atmospheric and Terrestrial Applications," Applied Optics, 44, N36, 7764-7772, 2005.**

**** Middleton, E.M., M.S. Kim, D.T. Krizek, and Ravinder B.K. Bajwa (2005). "Evaluating UV-B Effects and EDU Protection in Soybean Leaves Using Fluorescence", Symposium-in-Print on the Effects of Ultraviolet Radiation on Terrestrial Ecosystems, *Photochemistry and Photobiology*, 81:1075-1085. [The issue's cover features a figure from this paper.]**